

## Vadose Zone Fact Sheet

### Rocky Flats Environmental Technology Site

**Background:** Rocky Flats Environmental Technology Site (RFETS) is a 29 km<sup>2</sup> (11 mi<sup>2</sup>) government-owned, contractor-operated facility located 26 km (16 mi) northwest of Denver, Colorado. The original mission was manufacturing components of nuclear weapons. The current mission is environmental restoration and waste management.

**Issues:** There are no vadose zone or ground water human exposure pathways, therefore remediation goals are to protect surface waters and the environment, and to limit potential migration. The role of the vadose zone in preventing actinide migration is currently under investigation.

**Vadose zone infiltration:** Recharge through the vadose zone ranges is estimated to be 2.5 to 3 cm (1 to 1.2 in) per year, but may be as high as 5.6 cm (2.2 in) during exceptionally wet years.

**Vadose zone characterization/remediation:** Contaminated vadose zone and ground water are being remediated under the same remedial actions. Remedial actions include accelerated cleanup of source areas followed by monitored natural attenuation or passive ground water collection and treatment systems installed at the distal ends of the plumes to capture ground water before reaching surface water.

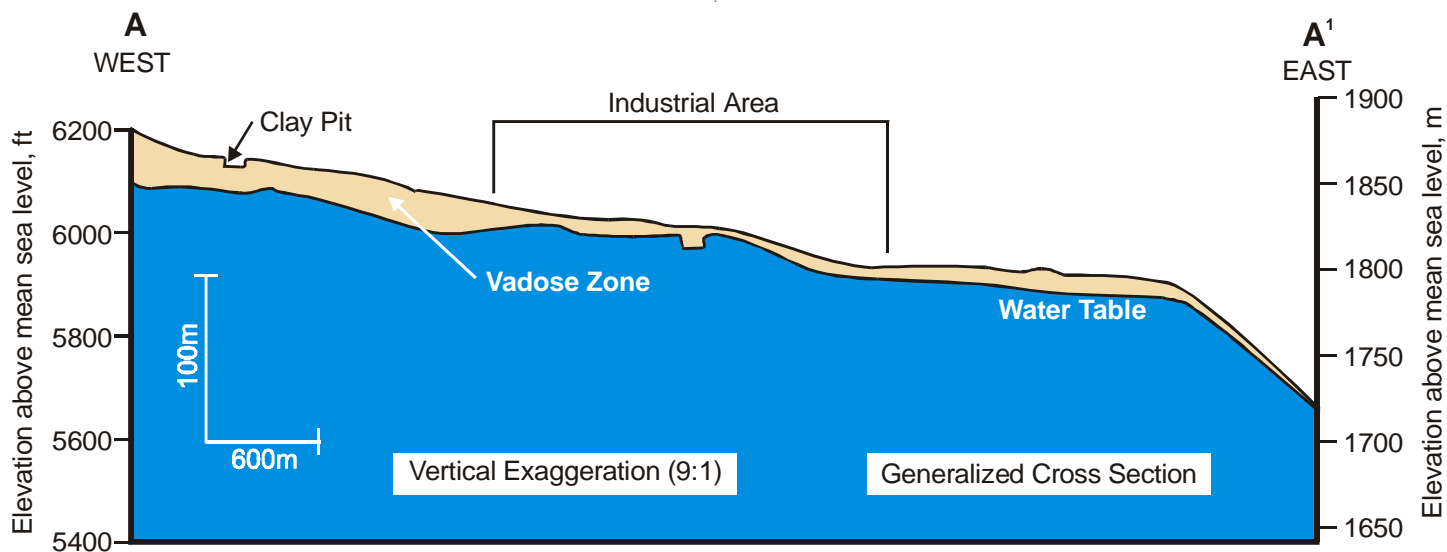
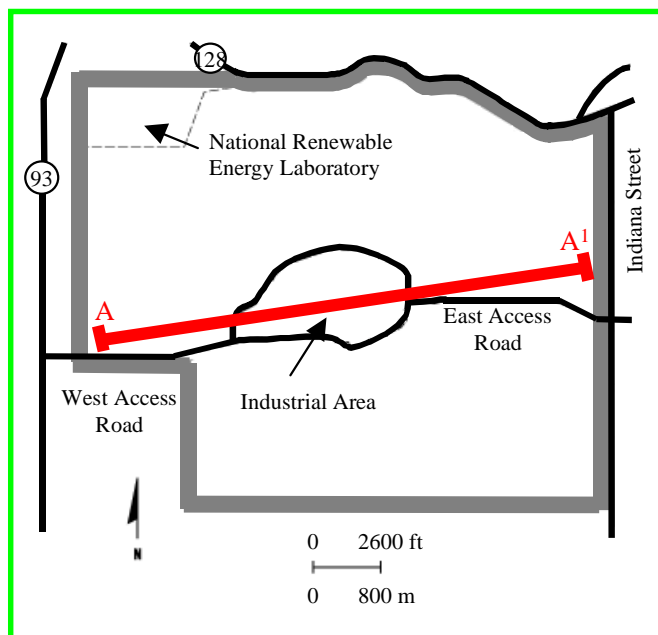
**Precipitation:** The site is temperate and semiarid, with an annual rainfall of 38 cm (15 in).

**Surface water:** Surface water flows west to east via five ephemeral streams. Three of the streams, the North Walnut Creek, the South Walnut Creek, and the Woman Creek, contain retention ponds, including large terminal retention ponds.

**Geology:** RFETS geomorphic surface is a broad, eastward sloping alluvial fan at an altitude of 1,829 m (6,000 ft) above mean sea level. Valley-fill alluvium, colluvium, and artificial-fill materials overlie bedrock consisting mainly of silty claystone, siltstone, sandstone, and coal.

**Vadose zone thickness:** The vadose zone ranges in thickness from zero at ground water discharge areas to 18 m (60 ft) on the west side of the site. In the Industrial Area, the vadose zone is typically 1.5 to 4.6 m (5 to 15 ft) thick.

**Major contaminants of concern:** The major contaminants of concern in the vadose zone and ground water are volatile organic compounds (primarily carbon tetrachloride, tetrachloroethane, and trichloroethylene), nitrates, and uranium.



## Ground Water Fact Sheet

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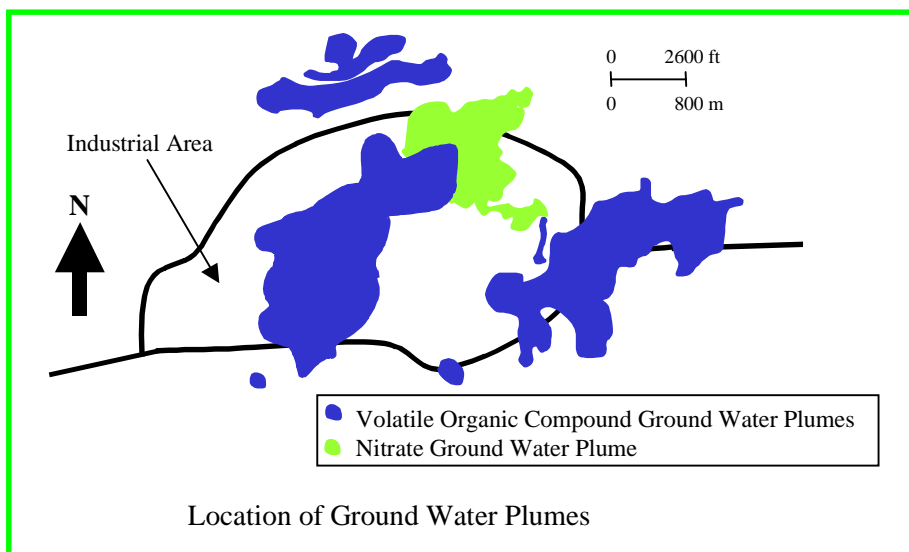
**Hydrogeology:** Ground water is present in the shallow, unconsolidated sediments, and subcropping bedrock throughout the site. The uppermost hydrostratigraphic unit is the predominant water-bearing unit of concern. It is composed of unconsolidated sandy and gravely material mixed with clay which is hydraulically connected to the alluvium. Seasonal fluctuations in saturated thickness are common and can range from 1 to 3 m (3 to 9 ft).

**Issues:** Contaminated ground water emerges as surface water before leaving the site. The programmatic goals are to protect surface waters and minimize contaminant migration.

#### Ground water

#### characterization/remediation:

A two-tiered action level approach to ground water remediation has been developed to protect surface waters and identify areas of ground water contamination potentially requiring cleanup. Tier I action levels consist of near-source action levels for accelerated cleanups, and Tier II action levels are protective of surface water qualities. Remedial actions are primarily monitored natural attenuation, or passive ground water collection and treatment systems installed at the distal ends of the plumes to capture ground water prior to reaching surface water. Dense non-aqueous phase liquids (DNAPLs) are probably present in the volatile organic compound plumes.



**Ground water use:** The ground water is not potable.

| Plume               | Primary Contaminants               | Remedial Approach             |
|---------------------|------------------------------------|-------------------------------|
| Mound Plume         | TCE; PCE; CCl <sub>4</sub> ; Am; U | Reactive barrier              |
| East Trenches Plume | TCE; PCE; CCl <sub>4</sub>         | Reactive barrier              |
| Solar Ponds Plume   | Nitrate; U                         | Reactive barrier              |
| 903 Pad Plume       | TCE; PCE; CCl <sub>4</sub> ;       | Monitored natural attenuation |

TCE = trichloroethylene; PCE = perchloroethylene; CCl<sub>4</sub> = carbon tetrachloride; Am = americium; U = uranium